DELTAELEKTRO

Review of Design documentation for execution

1.1 Cover page

Investor: Consortium of companies: China Railway International Corporation Ltd. and China Communication Construction Company Ltd.

Facility: Belgrade - Subotica Railway State Border (Kelebija), Section of the Novi Sad - Subotica - State Border (Kelebija) Railway

Project Title: Review of Design Documentation – Design books

Type of Technical Documentation: Detailed Design – Design for execution

For Construction/Execution of Works: Reconstruction - New Construction

Professional: Vukašin Pantelić, B.Sc. in Civil Engineering

Consultant: Deltaelektro Ltd. Belgrade (Čukarica), Žarkovačka 2d

Belgrade, Oktober 2024.

1.2 Contents of the Documentation Review:

1.1 Cover Page
1.2 Design content
1.3 Introduction
1.4 Review of Design books
1.5 Design book 2/2.4.1 OPEN RAIL VRBAS NOVA – LOVĆENAC-MALI IĐOŠ
1.6 Design book 2/2.4.2 LOVĆENAC-MALI IĐOŠ STATION
1.7 Design book 2/2.4.3 OPEN RAIL LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA
1.8 Design book 2/2.4.4 STATION BAČKA TOPOLA
1.9 Design book 2/2.4.5 OPEN RAIL BAČKA TOPOLA – ŽEDNIK
1.10 Design book 2/2.4.6 STATION ŽEDNIK
1.11 Design book 2/2.4.7 OPEN RAIL ŽEDNIK – NAUMOVIĆEVO
1.12 Design book 2/2.5.1 STATION NAUMOVIĆEVO
1.13 Design book 2/2.5.2 OPEN RAIL NAUMOVIĆEVO - SUBOTICA
1.14 Design book 2/2.5.3 STATION SUBOTICA
1.15 Design book 2/2.5.4 OPEN RAIL SUBOTICA – STATE BORDER
1.16 Design book 2/2.6.1 UPPER STRUCTURE PROJECT FOR BRIDGE STRUCTURES LONGER THAN 40 m – NOVI SAD – RUMENKA (EXIT) SECTION
1.17 Project File 2/2.6.2 UPPER STRUCTURE PROJECT FOR BRIDGE STRUCTURES LONGER THAN 40 m – RUMENKA (EXIT) – VRBAS NOVA PASSENGER (ENTRANCE) SECTION)
1.18 Project File 2/2.6.3 UPPER STRUCTURE PROJECT FOR BRIDGE STRUCTURES LONGER THAN 40 m – VRBAS NOVA (ENTRANCE) – NAUMOVIĆEVO (ENTRANCE) SECTION)
1.19 Project File 2/2.6.4 UPPER STRUCTURE PROJECT FOR BRIDGE STRUCTURES LONGER THAN 40 m – NAUMOVIĆEVO (ENTRANCE) – STATE BORDER SECTION
1.20 Conclusion

1.3 Introduction

Railway line Novi Sad - Subotica section represents a corridor of high significance both nationally and internationally. Nationally, it connects major railway station and numerous settlements along its route. Internationally, it serves as a link between Southeastern Europe, the Middle East, Central Europe, and the European Union.

The project involves a combination of reconstructing the existing railway line and constructing a new one, along with associated railway infrastructure. The aim is to create a modern double-track railway throughout the entire stretch, capable of accommodating both passenger and freight traffic, with speeds of up to 200 km/h. This upgrade is intended to showcase the railway's advantages in terms of safety, comfort, and environmental protection. An essential aspect of the project is the implementation of state-of-the-art signaling and telecommunication systems to ensure the aforementioned goals are achieved.

1.4 Review of Design books

The project "Belgrade - Subotica State Border (Kelebija) Railway, Section of the Novi Sad - Subotica - State Border (Kelebija)" constitutes a segment of the main railway line number 105, also known as the Belgrade - Budapest corridor E85. It includes sections of open railway tracks and stations, which, due to their nature and various technical parameters, have divided the project into smaller units. These parts are contained within design books labeled as 2/2 Lower and Upper Structure.

Design books would be included in the further processing - review of technical documentation:

2/2.4.1 OPEN RAIL VRBAS NOVA – LOVĆENAC-MALI IĐOŠ

2/2.4.2 STATION LOVĆENAC – MALI IĐOŠ

2/2.4.3 OPEN RAIL LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA

2/2.4.4 STANICA BAČKA TOPOLA

2/2.4.5 OTVORENA PRUGA BAČKA TOPOLA – ŽEDNIK

2/2.4.6 STATION ŽEDNIK

2/2.4.7 OPEN RAIL ŽEDNIK – NAUMOVIĆEVO

2/2.5.1 STATION NAUMOVIĆEVO

2/2.5.2 OPEN RAIL NAUMOVIĆEVO - SUBOTICA

2/2.5.3 STATION SUBOTICA

2/2.5.4 OPEN RAIL SUBOTICA – DRŽAVNA GRANICA

2/2.6.1 The Upper Structure Project for Bridge Structures Longer Than 40 m – Section from Novi Sad to Rumenka (Exit)

2/2.6.2 The Upper Structure Project for Bridge Structures Longer Than 40 m – Section from Rumenka (Exit) to Vrbas Nova Passenger (Entrance)

2/2.6.3 he Upper Structure Project for Bridge Structures Longer Than 40 m – Section from Vrbas Nova (Entrance) to Naumovićevo (Entrance)

2/2.6.4 The Upper Structure Project for Bridge Structures Longer Than 40 m – Section from Naumovićevo (Entrance) to State Border

For each book as a separate unit, it is necessary to include Book 2/2.0 Technical Conditions for Execution of Works.

1.5 2/2.4.1 OPEN RAIL VRBAS NOVA – LOVĆENAC-MALI IĐOŠ

Contained within 5 design books:

- *2/2.4.1.1 PROJECT OF RAILWAY TRACK AND STATIONS – LOWER AND UPPER STRUCTURE – OPEN RAIL VRBAS NOVA – LOVĆENAC-MALI IĐOŠ PART 1/5 - TEXTUAL DOCUMENTATION, SITUATION PLAN, AND LONGITUDINAL PROFILES*
- *2/2.4.1.2 PROJECT OF RAILWAY TRACK AND STATIONS – LOWER AND UPPER STRUCTURE – OPEN RAIL VRBAS NOVA – LOVĆENAC – MALI IĐOŠ PART 2/5 – CROSS SECTIONS*
- *2/2.4.1.3 PROJECT OF RAILWAY TRACK AND STATIONS – LOWER AND UPPER STRUCTURE – OPEN RAIL VRBAS NOVA – LOVĆENAC – MALI IĐOŠ PART 3/5 – CROSS SECTIONS*
- *2/2.4.1.4 PROJECT OF RAILWAY TRACK AND STATIONS – LOWER AND UPPER STRUCTURE – OPEN RAIL VRBAS NOVA – LOVĆENAC – MALI IĐOŠ PART 4/5 – CROSS SECTIONS*
- *2/2.4.1.5 PROJECT OF RAILWAY TRACK AND STATIONS – LOWER AND UPPER STRUCTURE – OPEN RAIL VRBAS NOVA – LOVĆENAC – MALI IĐOŠ PART 5/5 – CROSS SECTIONS*

The open railway track Vrbas Nova – Lovćenac – Mali Iđoš is a part of the main railway line E85 and extends from kilometer point 114+244.04 to kilometer point 128+849.48. It connects two stations at new locations designated for passenger traffic.

The documentation's background, including the project brief provided by the Investor, adheres to applicable laws, regulations, ordinances, topographic data, and standards for designing structures. A condition specified in the project is that the works must be carried out with total traffic closure (stop). The majority of the route is designed within a new corridor. The graphical documentation accurately depicts both the existing route and the proposed changes.

In addition to the condition that the project involves reconstruction and utilizes a known route, detailed engineering-geological surveys and investigations were necessary. These surveys and investigations were crucial for defining the geotechnical conditions for constructing the railway and its associated structures..

In order to achieve the desired speeds while ensuring traffic safety, intersections with roads must not be at grade level but rather resolved through grade separation. All grade separations in the form of viaducts, overpasses, and underpasses have been considered in the project, depicted in the graphical section, and thoroughly addressed in their respective sections within

the road portion. All electrical power line crossings, as well as crossings with gas and oil pipelines, have been addressed in separate sections for relocation and protection. Crossings with irrigation channels are addressed with appropriate culverts through the railway track bed.

The technical parameters on this section are:

- Speed for the main passing track of the open railway line 200 km/h
- Track gauge 1435 mm
- Wheelbase distance 4,50 m
- Maximum gradient of the track profil from 5,5‰
- Minimum gradient of the track profile from 1,0‰
- Dual grade on the longitudinal profile from 5%
- Rail 60E1 steel quality R260
- Concrete sleepers 2,60 m

And as such, they are suitable for the new mainline section under construction, for the open track portion extending from the station tracks. All in accordance with railway regulations and referring to relevant standards.

The materials to be installed on the upper structure, according to technical specifications, meet all the requirements of modern railways. They must be certified and installed in accordance with construction regulations. It is recommended to pay extra attention to daily temperatures during construction. All welded joints must comply with the standards prescribed by the standards SRPS EN 16843.

As that the railway track traverses through the flat areas of the Pannonian Plain, where clayey and dusty materials prevail, special emphasis is placed on the lower structure elements in the project. The project envisages sourcing material from borrow pits, with transportation costs factored into the estimates. Additionally, the project offers the option of selecting material replacement technology, either through stone replacement or stabilization of local material using a cement-lime mixture, as well as the application of geosynthetics. The replacement works should be planned in consultation with the Supervising Authority through an appropriate execution methodology, all with the aim of meeting deadlines and work schedules.

For the lower structure elements and embankments, particularly those projected in the approach ramps, the project specifies stringent load-bearing requirements typical for the construction and enhancement of mainline railways. Construction methodologies must include continuous monitoring of settlement, especially on existing embankments where material replacement will be conducted to improve stability, all in accordance with technical specifications.

The geometry of the track alignment is typical for flat terrain, and there's no need to push to the extreme limits. As such, the railway track is mostly in embankment. However, as a grade-separated bypass around populated areas, canals, and roads, I would mention a viaduct as a significant structure on this section. The viaduct, constructed of concrete, spans 1463 meters

and is designed within a circular curve with a radius of 5000 meters, without changing the track spacing, with precisely defined rail elevation in the curve.

For areas with high groundwater levels, the Project includes the installation of a drainage layer.

Upon reviewing longitudinal profiles, it is noted that flat terrain features are utilized along the route, with the maximum applied gradient of the track profile reaching 5.5%.

The cross-section profiles are presented at intervals of 25 meters, scaled at 1:100, while characteristic profiles are provided at twice the scale, 1:50, and include drainage system details. A characteristic cross-section profile for the viaduct is not included.

The calculation of work quantities is detailed in the Project, and there shouldn't be significant deviations, except for the part involving the construction of lower structure layers. Due to the soil conditions, material replacement and stabilization may be necessary until the desired results are achieved. Everything is considered in a clear Bill of Quantities.

The estimated investment value of works on this section was provided based on the bill of quantities from the beginning of 2022. However, due to the consequences of the war in Ukraine and the global COVID-19 pandemic, which have led to disruptions in the construction material market, this estimate may not be realistic. It can be expected that the cost of works on the Project will increase.

The conclusion is that the Design book has been meticulously prepared, including the accompanying graphical documentation, all in accordance with current laws, regulations, and standards applicable to the railway industry. It references the relevant standards that apply to railways and is an integral part with Book 2.2.0 Technical Conditions. The project places great emphasis on safety and environmental protection, both during construction and future operation.

1.6 2/2.4.2 STATION LOVĆENAC – MALI IĐOŠ

Contained within a single design book:

- *2/2.4.2 PROJECT OF RAILWAY TRACK AND STATIONS – LOWER AND UPPER STRUCTURE – STATION LOVĆENAC – MALI IĐOŠ*

It is designed on a completely new location with the takeover of the functions of the existing stations Lovćenac and Mali Iđoš. It is part of the main railway line E85 and extends from kilometer point 128+849.48 to kilometer point 130+141.85. In addition to two main passing tracks, two arrival-departure tracks are also designed, interconnected with 10 switches. Apart from serving passenger transport, the station is designed for overtaking freight trains.

The background used for the documentation, including the project task set by the Investor, adheres to current laws, regulations, ordinances, topographic data, and standards for designing structures. A condition specified by the project is that the works must be carried out with full traffic closure. The station is designed at a new location.

The new station location necessitates detailed engineering-geological surveys and investigations for the lower structure, defining the geotechnical conditions for constructing the station and its ancillary facilities. The station does not include a station building and does not provide for freight exchange. Buildings for telecommunication (TK) and power supply (SS) are planned.

Achieving speeds of 200 km/h must align with traffic safety, necessitating that intersections with roads not be at grade level. Therefore, the existing level crossing is eliminated. Access roads are provided only on one side, the right side, following the railway corridor. They connect to local roads on both sides, linking the populated areas of Lovćenac and Mali Iđoš, hence there is no need for a turnaround. The new roads planned in the project are depicted in the graphical documentation and are detailed in their respective sections within the road works. All electrical crossings, as well as crossings with gas and oil pipelines, are addressed in separate sections for relocation and protection.

The technical parameters on this section are:

- The speed for the main running track of the open railway 200 km/h
- Speeds in curves 80km/h
- Track gauge 1435 mm
- Distance between the axles of passing tracks: 4.75 m
- Distance between the axles of passing tracks from the entrance 6,40 m
- Length of the arrival-departure track 750 m
- Sation gradient 1,0 ‰
- Two-way gradient of the track bed: 5%
- Rail type 60E1 steel quality R260
- Concrete sleepers 2,60 m
- Turnouts 60E1-760-1:14 n concrete sleepers
- Platform height 55 cm

And as such, they are suitable for the station section of the new mainline railway under construction, for the needs of station tracks, all in accordance with railway regulations and referencing the appropriate standards.

Since the station route is designed in flat terrain with shallow embankments where clayey and dusty materials predominate, with low load-bearing capacity, special attention is given to the lower structure elements in the project. The project plans to source material from a single

borrow pit, and the cost of transportation is considered for a transport distance of 52 km. Local material is reinforced with geocomposite. Efforts should be made to conduct material replacement works in consultation with the Supervising Authority through an agreed methodology to ensure adherence to deadlines and work schedules.

For the lower structure elements in the embankment, the project specifies stringent load-bearing conditions typical for the construction and enhancement of mainline railways. Construction methodologies must include constant monitoring of settlement, all in accordance with technical specifications and regulations.

The materials to be incorporated into the upper structure, according to technical specifications, meet all the requirements of modern railways. They must be certified and installed in accordance with construction regulations. Rails meeting the required project speed, laid on concrete sleepers secured with elastic fastenings, fully meet the purpose of the station tracks. Turnouts connecting this station are of uniform type 60E1-760-1:14 and are graphically represented in the turnout layout plan with detailed tabular representations. All turnouts are delivered with corresponding concrete sleepers and assembly diagrams..

The recommendation is to pay additional attention to daily temperatures during construction works. All welded joints, both those in rail sections and those executed in the field, must comply with the standards prescribed by the SRPS EN 16843 standard.

The connection of station platforms, as well as their connection to the station approach, is designed with a station underpass. The dimensions of the underpass correspond to the station's purpose. The construction and architecture of the station underpass are elaborated in separate volumes of the project. Each side of the underpass is equipped with a lift for vertical communication.

The platforms, with their dimensions, meet the station's needs for small towns like Lovćenac and Mali Iđoš and the projected train composition lengths. However, on a railway of international and national significance, they could have been up to 300 m long. The platform surface has a cross slope within the limits prescribed by regulations for drainage purposes but is not marked on cross-sectional profiles.

Drainage of underground and atmospheric precipitation from the station tracks and facilities is designed with a drainage system. Four drains, or two pairs of drains located between the main and departure tracks, collect water from the station and channel it to drainage channels on both sides of the station. The drainage system is detailed in all graphic documents of the project volume, following previous hydraulic analyse.

The station also has two refuge sidings for each direction, equipped with elastic bumpers at their end.

As a facility, the station is enclosed on both sides by a fence with the required characteristics, similar to those on highways

Cross-sectional profiles are provided at a scale of 1:100 at intervals of 25m, while characteristic profiles are given at twice the scale, 1:50, including details at a scale of 1:20

The calculation of work quantities is detailed in the Project and should not have significant deviations, except in the part concerning the construction of lower layers, where material replacement and stabilization may be necessary due to varying soil conditions. This is thoroughly considered in the bill of quantitie.

The estimated investment value of works on this section is based on estimates from early 2022. However, due to the consequences of the war in Ukraine and the global COVID-19 pandemic, which have disrupted the construction material market, this estimate may not be realistic, and an increase in project costs can be expected.

In conclusion, the Design book has been elaborated in detail, including accompanying graphic documentation, all in accordance with applicable laws, regulations, and standards in the railway sector. It is an integral part with Book 2.2.0 Technical Conditions. A significant emphasis in the project is placed on traffic safety, passenger safety, and environmental protection, both during construction and future operation.

1.7 2/2.4.3 OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA

Contained in 6 Design books:

- *2/2.4.3.1 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA PART 1/6 – TEXT DOCUMENTATION, LAYOUT PLAN AND LONGITUDINAL PROFILES*
- *2/2.4.3.2 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA PART 2/6 – CROSS SECTIONS*
- *2/2.4.3.3 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA PART 3/5 – CROSS SECTIONS*
- *2/2.4.3.4 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA PART 4/5 – CROSS SECTIONS*
- *2/2.4.3.5 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA PART 5/5 – CROSS SECTIONS*
- *2/2.4.3.6 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK LOVĆENAC – MALI IĐOŠ – BAČKA TOPOLA – PART 6/6 – CROSS SECTIONS*

The open railway line Lovćenac - Mali Iđoš - Bačka Topola is part of the main line E85 and extends over chainages km 130+141.85 - km 142+691.40. It connects two stations, where the station Lovćenac - Mali Iđoš is a new railway station that was created by merging the existing stations Lovćenac and the stop Mali Iđoš. The station buildings in the Lovćenac and Mali Iđoš railway stations have the status of cultural property, and are not intended for demolition, and the Design does not envisage any work on them either. This section of the railway was designed in the existing railway corridor, that is, the designed right track is in the zone of the existing track, and the designed left track was added with minimal space occupation,

especially at the entrance to Bačka Topola, where the existing houses are located on the right side of the railway corridor. The graphic documentation neatly shows the currently existing route.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological examination of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

The condition that the Design specifies is that the works take place in a complete closure of railway traffic. In addition to the condition that part of the project is a reconstruction and that a known route is used, detailed engineering-geological examination of the substructure and tests were necessary on the basis of which the geotechnical conditions for the construction of the railway and its accompanying facilities were defined.

In order to achieve the required speeds, and all in accordance with the safety of traffic, intersections with road traffic must not be in level, but must be solved by denivelation. All denivelations in the form of viaducts, overpasses and underpasses are considered by the Design, shown in the graphic part and all are processed in their Design Books. All electric power intersections, as well as intersections with gas and oil pipelines, are processed with special Design Books for relocation and protection. Crossings with irrigation canals with appropriate culverts through the railway trunk.

In order to comply with all elements of environmental protection and nature protection, an above-ground denivelation crossing for wild animals was designed on this section of the railway at km 137+300, 20 meters wide. Furthermore, on this part of the route, the Project envisages the following facilities: viaduct from km 131+586.04 to km 132+075.34; 5 road deviations: at km 131+245.45, km 132+022.54, km 135+113.01, km 139+003.02, km 142+055.50. All deviations are processed in special books of the Project.

The technical parameters on this section of the railway are:

- Speed for the main passing tracks of the open track up to 200 km/h,
- Track width 1435 mm,
- Distance of the track axis on the open track is 4.50 m,
- The maximum slope of the level of 5.0‰,
- The minimum slope of the level of 0.0‰,
- Two-sided planum slope of 5%,
- Rail 60E1 quality steel R260,
- Concrete sleepers 2.60 m on main tracks.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. It is recommended to pay additional attention to the daily temperatures during the execution of the works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

As the railway route stretches through the flat parts of the Pannonian plain, where terrains of low load capacity prevail - clayey and dusty materials, the Design places a special emphasis on the elements of the substructure.

Due to the characteristics of the terrain, in areas where high levels of groundwater may occur, the Design envisages subsoil stabilization or the installation of geotextiles/geogrids with material replacement in the subsoil.

The Design envisages that the material is taken from the borrow pits, the locations of which are foreseen in the Design, and the cost of transporting the material from the nearest material borrow pits was taken into account in the estimate, due to the fact that there are no quality material borrow pits along the route of the future railway, especially for the layers of the upper parts of the embankment. The Design gave the opportunity to choose the technology of material replacement, either with replacement stone or stabilization of local material with a cement-lime mixture, as well as applications of geosynthetics with replacement of materials. Replacement works should be planned in agreement with the Supervisory Authority through the methodology of the works, all with the aim of respecting the deadlines and the dynamics of the works.

Regarding the construction of the embankment, recommendations were given for the materials to be used, and the maximum height of the embankment layers in stages. Before, during and after the completion of the works, the settlement of high embankments must be monitored geodetically.

Cross sections are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where, due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design Book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Project was given to safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Body. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

1.8 2/2.4.4 STATION BAČKA TOPOLA

Contained in one Design book:

- *2/2.4.4 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – STATION BAČKA TOPOLA*

The designed Bačka Topola station starts at the chainage km 142+682.79 and ends at km 144+327.41. During the designing, the existing space limitations in the station complex were taken into account, bearing in mind that the existing station has 7 station tracks and 2 industrial tracks, as well as a warehouse with a warehouse ramp, a military ramp, a car scale, a privately owned warehouse and two road crossings. The station building has the status of a cultural property. The designed condition includes 7 tracks, two main transit tracks, 2 receiving-dispatch tracks for passenger transportation, 3 manipulative tracks, and two protective tracks 50 meters long and 23 switches. All existing connections for industry were retained, and a ramp for goods work and a truck scale were also designed. Two platforms with canopies were designed, 55 cm high above GIŠ, 400 m long.

Road crossings are abolished, and deviations are planned at km 142+712.52 and km 143+729.21.

Due to the level of the railway and the expected speed, the Design defines the fencing of the station with a fence as on the highway, on both sides of the station.

The reconstruction and adaptation of the existing station building is planned, which is covered in a separate book.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological examination of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

All electric power intersections, as well as intersections with gas and oil pipelines, are processed with special Design books for relocation and protection.

The technical parameters in the area of the station are as follows:

- Speed for main passing tracks 200 km/h
- Turning speeds of 80 km/h and 50 km/h, depending on the type of turnout
- Track width 1435 mm
- The track axis distance of the station tracks is 4.75 m
- The track axis distance of the receiving-dispatching and main passing tracks is 6.40 m
- The useful length of the reception-dispatch track 1 is 834 m, 4 is 756 m
- Slope of the station 1.0 ‰
- Two-sided slope of the planum of 5%
- Rail 60E1, steel quality R260, on main and receiving-dispatching tracks
- Rail 49E1 quality R260 on manipulative and industrial tracks
- Concrete sleepers 2.60 m on main and receiving-dispatch tracks
- Concrete sleepers 2.40 m on manipulative and industrial tracks
- Turnouts 60E1-760-1:14, 60E1-300-6°, 49E1-300-6°
- Platform height 55 cm

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

Bačka Topola station is designed in a shallow embankment, there is no existing channel network that is being reconstructed and there are no designed culverts. Drainage is solved by longitudinal and transverse slopes of the planum, and concrete channels that go into the absorption fields. For the elements of the substructure in the embankment, the Design envisages strict load-carrying conditions intended for the construction and improvement of railways of a magisterial nature. Work execution methodologies must be with constant monitoring of settlement, and all according to technical conditions and valid regulations.

The Design places a special emphasis on the elements of the substructure, and it is foreseen that the material will be taken from the loan site, and the cost of transport for the transport distance of 10 to 15 km has also been taken into account. Due to the possible high level of underground water, the Design's recommendation is to stabilize the subsoil by adding lime or by installing gotextile and geogrid with replacement of subsoil material. Strive to carry out the replacement works in agreement with the Supervisory Authority through the execution methodology, all with the aim of respecting the deadlines and the dynamics of the works.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. The rails meet the required design speed and load, placed on concrete sleepers attached with elastic fastening, they fully correspond to the purpose of the tracks in the station. The switches that connect this station are of type 60E1-760-1:14, 60E1-300-6°, 49E1-300-6° and are graphically presented on the switch layout scheme with detailed tabular views. All turnouts are delivered with associated concrete sleepers and schetches for their assembly.

It is recommended to pay additional attention to the daily temperatures during the execution of the works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

The connection of the station platforms, as well as their connection with the approach to the station, is designed with a station underpass at km 143+504.76. The dimensions of the underpass correspond to the purpose of the station. The construction and architecture of the station underpass are covered in separate volumes of the Design. One elevator was designed on each platform for vertical communication, and side ramps were also designed for the smooth exit of pedestrians to the platform, which meets the requirements of TSI PRM.

Cross sections are given at a scale of 1:100 at 25 m, while the characteristic ones are given at a double scale of 1:50, the graphic processing of the project also includes details at a scale of 1:20.

The calculation of the amount of work is given in detail in the Design and there should not be any major deviations, except for the part of making the layers of the substructure, where due to the soil in which the work will take place, material replacement and stabilization will have to be carried out until the required results are obtained, as well as on parts of removing the layer of humus, which can vary. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design Books were made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Project was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly

deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

1.9 2/2.4.5 OPEN TRACK BAČKA TOPOLA – ŽEDNIK

Contained in 4 Design Books:

- *2/2.4.5.1 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK BAČKA TOPOLA – ŽEDNIK PART 1/4 - TEXT DOCUMENTATION, LAYOUT PLAN AND LONGITUDINAL PROFILES*
- *2/2.4.5.2 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK BAČKA TOPOLA – ŽEDNIK PART 2/4 – CROSS SECTIONS*
- *2/2.4.5.3 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK BAČKA TOPOLA – ŽEDNIK PART 3/4 – CROSS SECTIONS*
- *2/2.4.5.4 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK BAČKA TOPOLA – ŽEDNIK PART 4/4 – CROSS SECTIONS*

The open track Bačka Topola - Žednik is a part of the main line E85 and extends over chainages km 144+327.41 – km 156+211.82. It connects two stations, and the existing Mali Beograd stop at km 152+238.42 is abolished. This section of the railway was designed in the existing railway corridor, that is, the designed right track is in the zone of the existing track, and the designed left track was added with minimal space occupation, especially at the entrance to Bačka Topola, where the existing houses are located on the right side of the railway corridor. The graphic documentation neatly shows the currently existing route.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological examination of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

The condition that the project specifies is that the works take place in a complete closure of railway traffic. In addition to the condition that part of the project is a reconstruction and that a known route is used, detailed engineering-geological investigations of the substructure and tests were necessary on the basis of which the geotechnical conditions for the construction of the railway and its accompanying facilities were defined.

In order to achieve the required speeds, and all in accordance with the safety of traffic, intersections with road traffic must not be in level, but must be solved by denivelation. Alldenivelations in the form of viaducts, overpasses and underpasses are considered by the Design, shown in the graphic part and all are processed in their books. All electric power intersections, as well as intersections with gas and oil pipelines, are processed with special

books for relocation and protection. There are no designed railway bridges on this part of the route, nor crossings with existing melioration canals.

In order to comply with all elements of environmental protection and nature protection, an above-ground denivelation crossing for wild animals at km 155+025, 20 meters wide, was designed on this section of the railway, which is covered by a special Designt book. Further, on this part of the route, the Project foresees two road deviations: at km 147+137.22 and an overpass over the railroad and at km 152+275 a deviation of the local road with an overpass. All deviations are processed in special books of the Design. Service roads were designed wherever spatial possibilities allowed, in order to access agricultural land.

Bearing in mind the rank of the railway and the design speed, fences were designed on both sides of the railway, as on highways, at 1 meter from the edge of the channel, i.e. the foot of the embankment.

The technical parameters on this section of the railway are:

- The speed for the main passing tracks of the open railway is 200 km/h,
- Track width 1435 mm,
- The track axis distance of the open track tracks is 4.75 m,
- Maximum slope of the level of 2.0‰,
- The minimum slope of the level of 0.0‰,
- Two-sided planum slope of 5%,
- Rail 60E1 quality steel R260,
- Concrete sleepers 2.60 m on main tracks.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. It is recommended to pay additional attention to the daily temperatures during the execution of works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

As the railway route stretches through the flat parts of the Pannonian plain, where terrains of low load capacity prevail - clayey and dusty materials, the Design places a special emphasis on the elements of the substructure.

Due to the characteristics of the terrain, in areas where high levels of groundwater may occur, the Design envisages subsoil stabilization or the installation of geotextiles/geogrids with material replacement in the subsoil.

The Design envisages that the material is taken from the borrow pits, the locations of which are foreseen in the Design, and the cost of transporting the material from the nearest material borrow pits was taken into account in the estimate, due to the fact that there are no quality material borrow pits along the route of the future railway, especially for the layers of the upper parts of the embankment. The project gave the possibility of choosing the material replacement technology, either with replacement stone or stabilization of local material with a cement-lime mixture, as well as the application of geosynthetics with replacement of materials. Replacement works should be planned in agreement with the Supervisory Authority through the methodology of the works, all with the aim of respecting the deadlines and the dynamics of the works.

Regarding the construction of the embankment, recommendations were given for the materials to be used, and the maximum height of the embankment layers in stages. Before, during and after the completion of the works, the settlement of the embankment must be monitored geodetically.

Cross sections are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where, due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was done in detail, including the accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Project was placed on safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Body. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

1.10 2/2.4.6 STATION ŽEDNIK

Contained in one Design Book:

- *2/2.4.6 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – STATION ŽEDNIK*

The designed station Žednik starts at the chainage km 156+211.82 and ends at km 157+500.66. During the designing, the existing spatial limitations in the station complex were taken into account, bearing in mind that the existing station has 6 station tracks and 1 industrial track, a side ramp that is not in operation, a warehouse for storing tools, a car scale and one road crossing. The station building has the status of a cultural property. The designed condition includes 6 tracks, two main transit tracks, 2 receiving-dispatch tracks for passenger transportation, 1 track for connection with industry, manipulative track, and two guard tracks 50 meters long and 13 switches. The link with the industry was maintained, and a truck scale was also designed at km 157+085.94. Two platforms with canopies were designed, 55 cm high above GIŠ, 220 m long, interconnected by an underpass at m 157+139.00.

The road crossing is canceled, and a deviation is planned at km 157+444.90 with an underpass at the exit of the Žednik station, and another road deviation at km 156+453.73 is also planned at the entrance of the station.

Due to the grade of the railway and the expected speed, the Project defines the fencing of the station with a fence as on the highway, on both sides of the station.

The reconstruction and adaptation of the existing station building is planned, which is covered in a separate book.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological investigations of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

All electric power intersections, as well as intersections with gas and oil pipelines, are processed with special books for relocation and protection.

The technical parameters in the area of the station are as follows:

- Speed for main passing tracks 200 km/h

- Turning speeds of 80 km/h and 50 km/h, depending on the type of turnout

- Track width 1435 mm

- The track axis distance of the main passing tracks is 4.75 m

- The track axis distance of the receiving-dispatching and main passing tracks is 6.40 m

- The useful length of the receiving-dispatch track 1 is 746 m, 4 is 693 m

- Station slope 0.0 ‰

- Two-sided slope of the planum of 5%

- Rail 60E1, steel quality R260, on main and receiving-dispatch tracks

- Rail 49E1 quality R260 on manipulative and industrial tracks

- Concrete sleepers 2.60 m on main and receiving-dispatch tracks

- Concrete sleepers 2.40 m on manipulative and industrial tracks

- Turnouts 60E1-760-1:14, 60E1-300-6°, 49E1-300-6°

- Platform height 55 cm

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The Žednik station is designed in a shallow embankment, there is no existing channel network and no designed culverts, drainage is solved by longitudinal and transverse slopes of the planum and concrete channels and drains that go into the designed retentions. For the elements of the substructure in the embankment, the Project envisages strict load-carrying conditions intended for the construction and improvement of railways of a magisterial nature. Work execution methodologies must be with constant monitoring of subsidence, and all according to technical conditions and valid regulations.

The Project places a special emphasis on the elements of the substructure, and it is foreseen that the material will be taken from the loan site, and the cost of transport for the transport distance of 5 to 10 km has also been taken into account. Due to the possible high level of underground water, the Project's recommendation is to stabilize the subsoil by adding lime or by installing gotextile and geogrid with replacement of subsoil material. Strive to carry out the replacement works in agreement with the Supervisory Authority through the execution methodology, all with the aim of respecting the deadlines and the dynamics of the works.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. The rails meet the required design speed and load, placed on concrete sleepers attached with elastic fastenings, they fully correspond to the purpose of the tracks in the station. The switches connecting this station are of type 60E1-760-1:14, 60E1-300-6°, 49E1-300-6° and are graphically presented on the situation with detailed tabular views, and a track layout scheme is also given. All turnouts are delivered with associated concrete sleepers and diagrams for their assembly.

It is recommended to pay additional attention to the daily temperatures during the execution of works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

The connection of the station platforms, as well as their connection with the approach to the station, is designed with a station underpass at km 157+139.00. The dimensions of the underpass correspond to the purpose of the station. The construction and architecture of the underpass are covered in separate volumes of the Design. One elevator was designed on each

platform for vertical communication, and side ramps were also designed for the smooth exit of pedestrians to the platform, which meets the requirements of TSI PRM.

Transverse profiles are given at 25 m scale 1:100, while the characteristic ones are given at twice the scale 1:50, the graphic processing of the project also includes details at the scale 1:20.

The calculation of the amount of work is given in detail in the Design and there should not be any major deviations, except for the part of making the layers of the substructure, where due to the soil in which the work will take place, material replacement and stabilization will have to be carried out until the required results are obtained, as well as on parts of removing the layer of humus, which can vary. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.4.7 OPEN TRACK ŽEDNIK – NAUMOVIĆEVO

Contained in 3 Design books:

- *2/2.4.7.1 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK ŽEDNIK - NAUMOVIĆEVO PART 1/3 - TEXT DOCUMENTATION, LAYOUT PLAN AND LONGITUDINAL PROFILES*
- *2/2.4.7.2 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK ŽEDNIK - NAUMOVIĆEVO PART 2/3 – CROSS SECTIONS*
- *2/2.4.7.3 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK ŽEDNIK - NAUMOVIĆEVO PART 3/3 – CROSS SECTIONS*

The open line Žednik - Naumovićevo is part of the main line E85 and extends over chainages km 157+500.66 – km 165+943.07. It connects two stations, and the existing Verušić stop at km 162+319.91 is abolished, as well as one of the two existing industrial tracks that are the connection to the azotara. This section of the railway was designed in the existing corridor of the railway, that is, the designed right track is in the zone of the existing track, and the designed left track was added with minimal space occupation. The graphic documentation neatly shows the currently existing route.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological investigations of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

The condition that the project specifies is that the works take place in a complete closure of railway traffic. In addition to the condition that part of the project is a reconstruction and that a known route is used, detailed engineering-geological investigations of the substructure and tests were necessary on the basis of which the geotechnical conditions for the construction of the railway and its accompanying facilities were defined.

In order to achieve the required speeds, and all in accordance with the safety of traffic, crossings with road traffic must not be in level, but must be solved by denivelation. All denivelations in the form of viaducts, overpasses and underpasses are considered by the Design, shown in the graphic part and all are processed in their books. All electric power intersections, as well as intersections with gas pipelines and oil pipelines, are processed with special books for relocation and protection. There are no planned railway bridges on this part of the route.

A concrete culvert measuring 4.10x2.70m was designed at the intersection with the "Čiker" canal. Drainage was solved by the slope and transverse slopes of the planum and concrete channels that were lowered into the projected retentions and into the "Chiker" channel.

On this part of the route, there are five level crossings. The Design envisages two road deviations: at km 160+094.84, at the place of the existing road crossing in front of the Verušić bus stop, the denivelation of the local road with an overpass is being carried out, and at km 163+566.52 the denivelation of the local road with an overpass, at the place of the existing road crossing behind Verušić stop. All deviations are processed in special books of the Design.

Service roads were designed wherever spatial possibilities allowed, in order to access agricultural land.

Bearing in mind the rank of the railway and the design speed, fences were designed on both sides of the railway, as on highways, at 1 meter from the edge of the channel, i.e. the foot of the embankment.

The technical parameters on this section of the railway are:

- The speed for the main passing tracks of the open railway is 200 km/h,

- Track width 1435 mm,

- The track axis distance of the open track tracks is 4.75 m,

- The maximum slope of the level of 2.5‰,

- The minimum slope of the level of 0.3‰,

- Two-sided planum slope of 5%,

- Rail 60E1 quality steel R260,

- Concrete sleepers 2.60 m on main tracks.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. It is recommended to pay additional attention to the daily temperatures during the execution of the works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

As the railway route stretches through the flat parts of the Pannonian plain, where terrains of low load capacity prevail - clayey and dusty materials, the Project places a special emphasis on the elements of the substructure.

Due to the characteristics of the terrain, in areas where high levels of groundwater may occur, the Design envisages subsoil stabilization or the installation of geotextiles/geogrids with material replacement in the subsoil.

The project envisages that the material is taken from the borrow pits, the locations of which are foreseen in the Design, and the cost of transporting the material from the nearest material borrow pits was taken into account in the estimate, due to the fact that there are no quality material borrow pits along the route of the future railway, especially for the layers of the upper parts of the embankment. The Design gave the possibility of choosing the material replacement technology, either with replacement stone or stabilization of local material with a cement-lime mixture, as well as the application of geosynthetics with replacement of materials. Replacement works should be planned in agreement with the Supervisory

Authority through the methodology of the works, all with the aim of respecting the deadlines and the dynamics of the works.

Regarding the construction of the embankment, recommendations were given for the materials to be used, and the maximum height of the embankment layers in stages. Before, during and after the completion of the works, the settlement of the embankment must be monitored geodetically.

Transverse profiles are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where, due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.5.1 STATION NAUMOVIĆEVO

Contained in one Design book:

- *2/2.5.1 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – STATION NAUMOVIĆEVO*

The planned Naumovićevo station starts at the chainage km 165+943.08 and ends at km 167+585.96. During the designing, the existing space limitations in the station complex were taken into account. The designed condition includes 4 station tracks, two main passing tracks, 1 track for the connection with the existing single-track main line for the Subotica freight

station and one track that is the connection to the existing industrial track for the azotara, as well as protective tracks and 14 switches. 220 m long platforms by the overtaking tracks were designed, as well as the construction of a pedestrian underpass and a canopy on the platforms. These objects are covered in separate volumes of the Project.

The existing road crossing at km 166+095 is being abolished, and road traffic is being redirected via the Cantavirski road and the newly built overpass on the Subotica by-pass.

Due to the grade of the railway and the expected speed, the Project envisages a protective wire fence, the position of which is shown in the graphic part of the documentation.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological investigations of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

All electric power intersections, as well as intersections with gas and oil pipelines, are processed with special books for relocation and protection.

The technical parameters in the area of the station are as follows:

- Speed for main passing tracks 200 km/h,

- Turning speed 80 km/h,

- Track width 1435 mm,

- The track axis distance of the main passing tracks is 4.75 m,

- The track axis distance of the receiving-dispatching and main passing tracks is 6.40 m,

- The useful length of the receiving-dispatch tracks is 850 m, and the main passing tracks are 985.42 m,

- Slope of the station 0.0 ‰, from the level break in km 166+218 main passing tracks in the ascent 1.0 ‰,

- Two-sided planum slope of 5%,

- Rail 60E1 quality steel R260 on all station tracks,

- Rail 49E1 quality R260 on the industrial track for Azotara and the track for Subotica Teretna,

- Concrete sleepers 2.60 m on station tracks,

- Concrete sleepers 2.40 m on the industrial track for the azotery and the track for the Subotica Teretna station,

- Turnouts 60E1-760-1:14,

- Platform height 55 cm.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The Naumovićevo station was designed in a shallow embankment, the drainage of the station plateau was solved by transverse slopes of the planum, channels and drains with transverse drains in the railway complex, and the final recipients were designed as absorption fields.

For the elements of the substructure in the embankment, the Project envisages strict load-carrying conditions intended for the construction and improvement of railways of a magisterial nature. Work execution methodologies must be with constant monitoring of settlement, and all according to technical conditions and valid regulations.

The Design places a special emphasis on the elements of the substructure, and it is foreseen that the material will be taken from the loan site, and the transport costs for the transport distance of 5 to 20 km have also been taken into account. From the hydrogeological aspect of the ground water level in the field, that is, the geotechnical conditions, the section is favorable to conditionally favorable, with a depth of ground water of 3 - 7.6 m from the ground surface, locally and shallower, from 0.7 - 1.5 m. Soil replacement or embankment reinforcement is planned in a thickness of 50 cm, and a waterproof geotextile is spread under the replacement layer, which directs water to the canals, and a geogrid that evens out the load-bearing capacity and solves the problem of variable quality of the subsoil at the junction of the existing embankment and spontaneous soil. Efforts should be made to carry out the replacement works in agreement with the Supervisory Authority through the execution methodology, all with the aim of respecting the deadlines and dynamics of the works.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. The rails meet the required design speed and load, placed on concrete sleepers attached with elastic fastenings, they fully correspond to the purpose of the tracks in the station. The switches connecting this station are of type 60E1-760-1:14 and are graphically presented on the situation with detailed tabular views, and a scheme for laying the switches and tracks is also given. All turnouts are delivered with associated concrete sleepers and diagrams for their assembly.

It is recommended to pay additional attention to the daily temperatures during the execution of the works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

The connection of the station platforms, as well as their connection with the approach to the station, is designed with a station underpass at km 166+446.80. The dimensions of the underpass correspond to the purpose of the station. The construction and architecture of the underpass are covered in separate volumes of the Project.

Transverse profiles are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where,

due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.5.2 OPEN TRACK PRUGA NAUMOVIĆEVO – SUBOTICA

Contained in 2 Design books:

- *2/2.5.2.1 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK NAUMOVIĆEVO - SUBOTICA PART 1/2 - TEXT DOCUMENTATION, LAYOUT PLAN AND LONGITUDINAL PROFILES*
- *2/2.5.2.2 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK NAUMOVIĆEVO - SUBOTICA PART 2/2 – CROSS SECTIONS*

The open railway line Naumovićevo - Subotica is part of the main line E85. It separates from the existing railway at km 168+400, and enters the Subotica Freight station along the existing regional railway Senta - Subotica. This section extends from the chainage km 167+585.96 – km 165+943.07. It connects two stations, and the existing Verušić stop at km 162+319.91 is abolished, as well as one of the two existing industrial tracks that are the connection to the azotara. This section of the railway was designed in the existing corridor of the railway, that is, the designed right track is in the zone of the existing track, and the designed left track was added with minimal space occupation. The graphic documentation neatly shows the currently existing route.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological investigations of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design

Standards that regulate this area, including TSI and UIC announcements, were used during the development.

The condition that the Design specifies is that the works take place in a complete closure of railway traffic. In addition to the condition that part of the project is a reconstruction and that a known route is used, detailed engineering-geological investigations of the substructure and tests were necessary on the basis of which the geotechnical conditions for the construction of the railway and its accompanying facilities were defined.

In order to achieve the required speeds, and all in accordance with the safety of traffic, crossings with road traffic must not be in level, but must be solved by denivelation. All denivelations in the form of viaducts, overpasses and underpasses are considered by the Design, shown in the graphic part and all are processed in their books. All electric power intersections, as well as intersections with gas pipelines and oil pipelines, are processed with special books for relocation and protection. There are no planned railway bridges on this part of the route.

A concrete culvert measuring 4.10x2.70m was designed at the intersection with the "Čiker" canal. Drainage was solved by the slope and transverse slopes of the planum and concrete channels that were lowered into the projected retentions and into the "Chiker" channel.

On this part of the route, there are five level crossings. The project envisages two road deviations: at km 160+094.84, at the place of the existing road crossing in front of the Verušić bus stop, the leveling of the local road with an overpass is being carried out, and at km 163+566.52 the leveling of the local road with an overpass, at the place of the existing road crossing behind Verušić stop. All deviations are processed in special books of the Design. Service roads were designed wherever spatial possibilities allowed, in order to access agricultural land.

Bearing in mind the rank of the railway and the design speed, fences were designed on both sides of the railway, as on highways, at 1 meter from the edge of the channel, i.e. the foot of the embankment.

The technical parameters on this section of the railway are:

- The speed for the main passing tracks of the open railway is 200 km/h,
- Track width 1435 mm,
- The track axis distance of the open track tracks is 4.75 m,
- The maximum slope of the level of 2.5‰,
- The minimum slope of the level of 0.3‰,
- Two-sided planum slope of 5%,
- Rail 60E1 quality steel R260,
- Concrete sleepers 2.60 m on main tracks.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. It is recommended to pay additional attention to the daily temperatures during the execution of works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

As the railway route stretches through the flat parts of the Pannonian plain, where terrains of low load capacity prevail - clayey and dusty materials, the Project places a special emphasis on the elements of the substructure.

Due to the characteristics of the terrain, in areas where high levels of groundwater may occur, the Project envisages subsoil stabilization or the installation of geotextiles/geogrids with material replacement in the subsoil.

The project envisages that the material is taken from the borrow pits, the locations of which are foreseen in the project, and the cost of transporting the material from the nearest material borrow pits was taken into account in the estimate, due to the fact that there are no quality material borrow pits along the route of the future railway, especially for the layers of the upper parts of the embankment. The project gave the possibility of choosing the material replacement technology, either with replacement stone or stabilization of local material with a cement-lime mixture, as well as the application of geosynthetics with replacement of materials. Replacement works should be planned in agreement with the Supervisory Authority through the methodology of the works, all with the aim of respecting the deadlines and the dynamics of the works.

Regarding the construction of the embankment, recommendations were given for the materials to be used, and the maximum height of the embankment layers in stages. Before, during and after the completion of the works, the settlement of the embankment must be monitored geodetically.

Transverse profiles are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where, due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.5.3 STATION SUBOTICA

Contained in 5 Design books:

- *2/2.5.3.1 TRACK AND STATION DESIGN – SUBSTRUCTURE – STATION SUBOTICA – TEXT DOCUMENTATION, LAYOUT PLAN AND LONGITUDINAL PROFILES*
- *2/2.5.3.2 TRACK AND STATION DESIGN – SUBSTRUCTURE – STANICA SUBOTICA – CROSS SECTIONS – FREIGHT STATION*
- *2/2.5.3.3 TRACK AND STATION DESIGN – SUBSTRUCTURE – STANICA SUBOTICA – CROSS SECTIONS – PASSENGER STATION*
- *2/2.5.3.4. TRACK AND STATION DESIGN – SUPERSTRUCTURE – STANICA SUBOTICA – FREIGHT STATION*
- *2/2.5.3.5. TRACK AND STATION DESIGN – SUPERSTRUCTURE – STANICA SUBOTICA – PASSENGER STATION*

The Subotica station is the most complex station on this route, as the complex includes a freight and passenger station. Furthermore, the condition of the Design is that the reconstruction works are carried out in phases, that is, with the railway traffic in operation. International and domestic passenger traffic takes place at the Subotica station, and it is also a border station for international trains, while it is the initial and final station for domestic traffic. The formation and disbanding of freight trains in international and domestic traffic, as well as hub trains, will take place at the Subotica Freight Station.

The beginning of the reconstruction is at km 174+174.98, the end of the section is at 177+300, and the reconstruction of the single-track railway from Senta is also planned, so that together with the main railway tracks they enter the Subotica station. The reconstruction includes 2 industrial tracks for Aleksandrovo and Subotica Bolnica, which connect to the Subotica Freight station at km 175+086, and at km 175+305, the regional single-track railway from Horgoš is

connected. The tracks for Sombor and Gaya are separated at the turnouts number 83 and 84, which are by denivelation taken through the gallery at km 177+627,79 from the main line.

At km 174+515.35, a new underpass was designed, over which 2 tracks of the main railway, 1 track of the railway from Senta and two industrial tracks cross. Furthermore, these tracks also cross the underpass at km 174+928.10, which is the subject of a separate design. Reconstruction of the existing overpass is planned between the Subotica Freight and Subotica Passenger stations at km 176+274.55. A passenger underpass is planned at km 176+610.91. The dimensions of the underpass correspond to the purpose of the station. The construction and architecture of the underpass are covered in separate volumes of the Project.

The projected state of the Subotica Freight station includes the reconstruction and construction of 5 tracks of the receiving-dispatch group for international, 5 tracks for domestic freight traffic and three auxiliary tracks, and these tracks will be electrified. Other tracks are not the subject of the design. The useful lengths of receiving-dispatch tracks for international traffic vary from 614 m to 798 m, auxiliary tracks 240-302 m, shunting-manipulative 597.75 m, and receiving-dispatch tracks for internal freight trains from 437 m to 484 m. The construction of a new official building and an official underpass at km 175+819 is also planned.

The projected state of the Subotica Passenger station includes the reconstruction and construction of 10 tracks for the needs of international and domestic passenger traffic, and 4 platforms, as well as the reconstruction of the existing track for loading cars with an access ramp, the track for the ETP Section and the bypass track.

The useful lengths of the reception-dispatch tracks are 205-322 m, the main through 416-562 m, the garage 210-316 m, and the reserve reception-dispatch and auxiliary 490 m.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological investigations of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

All crossings of railways with road traffic are solved by denivelation, with the aim of maximum safety of railway traffic.

A protective wire fence and constructions for noise protection are foreseen as technical measures for environmental protection, the position of which is shown in the graphic part of the documentation.

The technical parameters in the area of the station are as follows:

- Speed in Subotica junction 100 km/h,

- Track width 1435 mm,

- The track axis distance of the main passing tracks is min. 4.5 m,

- The track axis distance of station tracks min 4.75 m,

- The distance between passing and overtaking tracks is 6.4 m,

- The useful track length in the Subotica Freight station is 650-750 m, and 250-450 m in the Subotica Passenger station,

- From the beginning of the section of level in an ascent of 5.9 ‰ to the entry to station where it is in an ascent of 1.0 ‰ to km 175+438, from where it is horizontal to km 176+810; the exit of the station is rising 1.3 ‰ in order to create space for the gallery where the two-track main line and the lines to Baja and Sombor intersect where the maximum slope is 12.5 ‰

- Two-sided planum slope of 5%, reduced to 3% in the zones of track connections,

- Rail 60E1 quality steel R260 on the main tracks,

- Rail 49E1 quality R260 on industrial tracks and other railways,

- Concrete sleepers 2.60 m on the main tracks,

- Concrete sleepers 2.40 m on industrial tracks and other railways,

- Switches on the left and right tracks of the main line are of type 60E1-R300-6°, on other tracks and tracks 49E1-R300-6°, 49E1-R200-6° (on concrete sleepers with an elastic fastening system and on wooden sleepers with "K" type rail fastening), 49E1-R215-6°

- Platform height 55 cm.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

Due to the complexity of this section of the railway, the superstructure was specially considered through special books of the Design, where all reconstruction and construction works included in this project are described in detail, as well as the integration of the section that is not the subject of works with the designed section, and the scope of work that needs to be carried out in order to carry out leveling and situational fitting on transition sections.

Drainage of the station plateau is solved by transverse slopes of the planum, channels and drains with transverse drains in the railway complex.

For the elements of the substructure, the Design envisages strict load-carrying conditions intended for the construction and improvement of railways of a magisterial nature. Work execution methodologies must be with constant monitoring of settlement, and all according to technical conditions and valid regulations.

From the hydrogeological aspect of the ground water level in the field, that is, the geotechnical conditions, the section is favorable to conditionally favorable, with a depth of ground water of 3 - 7.6 m from the ground surface, locally and shallower, from 0.7 - 1.5 m. Soil replacement or embankment reinforcement is planned in a thickness of 50 cm. And the installation of geotextiles and geogrids, and over the geogrid it is necessary to install crushed stone in order to realize the function of increasing the load capacity and ensuring the stability of the soil. Efforts should be made to carry out the replacement works in agreement with the Supervisory

Authority through the execution methodology, all with the aim of respecting the deadlines and dynamics of the works.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. The rails meet the required design speed and load, placed on concrete sleepers attached with elastic fastening, they fully correspond to the purpose of the tracks in the station. The switches in the stations are of the type 60E1-R300-6°, 49E1-R300-6°, 49E1-R200-6°, 49E1-R215-6° and are graphically presented on the situation with detailed tabular views, and a scheme for laying the switches is given and track. All turnouts are delivered with associated concrete/wooden sleepers and diagrams for their assembly.

It is recommended to pay additional attention to the daily temperatures during the execution of the works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

Transverse profiles are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where, due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.5.4 OPEN TRACK SUBOTICA – STATE BORDER

Contained in 2 Design books:

- *2/2.5.4.1 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK SUBOTICA – STATE BORDER – PART 1/2 - TEXT DOCUMENTATION, LAYOUT PLAN AND LONGITUDINAL PROFILES*
- *2/2.5.4.2 TRACK AND STATION DESIGN – SUBSTRUCTURE AND SUPERSTRUCTURE – OPEN TRACK SUBOTICA – STATE BORDER - PART 2/2 – CROSS SECTIONS*

Changes to the alignment of the railway line between the Republic of Serbia and the Republic of Hungary in the border area from km 184+458.43 to km 184+634.98 are the subject of a separate Technical Solution.

The open railway line Subotica - state border is part of the main line E85. The section of this railway was designed in the corridor of the existing railway, starts at km 177+300 and ends at km 184+634.98, because it is defined that all the pullout track and associated tracks of the Subotica station will be elaborated in that Design book.

The bases used for the preparation of documentation include the Investor's Project Terms of Reference, updated topographical bases, geological investigations of the substructure on the section Novi Sad - Subotica - state border, data on the position of railway cables and other documentation submitted by the Investor. Furthermore, valid Laws, Rules, Regulations, Design Standards that regulate this area, including TSI and UIC announcements, were used during the development.

In addition to the condition that part of the project is a reconstruction and that a known route is used, detailed engineering-geological investigations of the substructure and tests were necessary on the basis of which the geotechnical conditions for the construction of the railway and its accompanying facilities were defined.

In order to achieve the required speeds, and all in accordance with the safety of traffic, crossings with road traffic must not be in level, but must be solved by denivelation. All denivelations in the form of viaducts, overpasses and underpasses are considered by the Design, shown in the graphic part and all are processed in their books. On this part of the route, the Design envisages the following road deviations: at km 177+857.12, the road crossing will be abolished, and the connection will be realized by building a new underpass; new overpasses were designed at km 179+395.78, km 180+970.30 and km 184+258.37, and at km 181+950.00 a new overpass was designed for the crossing of large wild animals and small animals.

All electric power intersections, as well as intersections with gas pipelines and oil pipelines, are processed with special books for relocation and protection. There are no designed railway bridges on this part of the route.

The existing overpass at the exit of the station is being demolished and a new one is being built at km 177+329.34. Further, in km 177+627.79, a gallery for the denivelation solution of this and the railways to Sombor and Baja was designed.

Bearing in mind the rank of the railway and the design speed, protective wire fences were designed, the position of which is shown in the graphic documentation.

The technical parameters on this section of the railway are:

- The speed for the main passing tracks of the open railway from the exit of the Subotica station in km 178+000 is 200 km/h,

- Track width 1435 mm,

- The track axis distance of the open track tracks is 4.75 m,

- Maximum slope of the level 12.5‰ main line, 17.5‰ other tracks,

- Two-sided planum slope of 5%,

- Rail 60E1 quality steel R260,

- Concrete sleepers 2.60 m.

Such technical parameters correspond to the conditions for the construction of new main railway lines, all in accordance with the valid railway rules and standards that define this area.

The materials that will be installed on the superstructure according to the Technical Conditions meet all the requirements of modern railways, must be certified and must be installed in accordance with the valid standards and rules governing this area. It is recommended to pay additional attention to the daily temperatures during the execution of the works. All welded joints must comply with the norms prescribed by the series of standards SRPS EN 14587 - ET welding, that is, SRPS EN 14730 - AT welding.

As the railway route stretches through the flat parts of the Pannonian plain, where terrains of low load capacity prevail - clayey and dusty materials, the Project places a special emphasis on the elements of the substructure.

In this section, the railway is mainly on a low embankment. The body of the double-track railway is attached to the body of the existing single-track railway, and the connection of the new and the existing one is made by cutting.

The geotechnical study recommends the creation of a 50 cm layer of crushed stone to reinforce the embankment or bedding, and under this, geotextiles and geogrids are to be installed. In this way, various subsidences are alleviated, especially in the parts where the channels of the existing railway are located under the new railway. The geotextile is installed in order to conduct water to the canals. In the section from km 177+700 to km 178+100, the height of the embankment is greater than 2 m (3-4 m high). Regarding the construction of the embankment, recommendations were given for the materials to be used, and the maximum height of the embankment layers in stages. Before, during and after the completion of the works, the settlement of the embankment must be monitored geodetically. On the entire section, the humus of the slopes with grassing is planned.

Drainage of the section is solved by transverse slopes of the planum, channels and a drainage system, with transverse drains in the railway complex. End recipients for lined concrete

channels are designed as self-absorbing and absorbent fields. The drainage system is shown in the graphic part of the documentation.

The Design envisages that the material is taken from the borrow pits, the locations of which are foreseen in the Design, and the cost of transporting the material from the nearest material borrow pits was taken into account in the estimate, due to the fact that there are no quality material borrow pits along the route of the future railway, especially for the layers of the upper parts of the embankment. The Design gave the possibility of choosing the material replacement technology, either with replacement stone or stabilization of local material with a cement-lime mixture, as well as the application of geosynthetics with replacement of materials. Replacement works should be planned in agreement with the Supervisory Authority through the methodology of the works, all with the aim of respecting the deadlines and the dynamics of the works.

Transverse profiles are given at 25m scale 1:100, while characteristic ones are given at twice the scale 1:50 and include details of the drainage system.

The calculation of the amount of work is given in detail in the Design and there should be no major deviations, except for the part of the construction of the substructure layers, where, due to the soil in which the work will take place, material replacement and stabilization will have to be done until the required criteria are met. Everything is considered in a clear scope of works.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.6.1 DESIGN FOR SUPERSTRUCTURE FOR BRIDGE STRUCTURES OF LENGTH OVER 40 m – SECTION NOVI SAD – RUMENKA (EXIT)

Based on the calculation of the vehicle/track/bridge interaction, Designs were made for the execution of the superstructure for bridge structures over 40 m long.

Bridge constructions over 40 m long on the section Novi Sad - Rumenka (exit) are covered in this Design Book. Also, this Design Book describes the bridges at km 76+615.75 and km 77+814, and the gallery at km 81+283.12, whose length is less than 40 m, with the calculation of the superstructure specific to bridge structures, which was not processed in the Design of the railway route.

This Design book includes the superstructure on the bridge structures and the superstructure at 10.4 m in front and behind the bridge structures (from the beginning to the end of the protective rail).

An elastomeric mat is envisaged, which is placed under the ballast bed, and concrete sleepers with elastomeric pads are laid in front of and behind the bridge in transition zones, on the basis of which a linear change in the stiffness of the base is achieved. It is necessary to ensure the connection of the entire surface of the pad with the sleeper, and the pads are installed in the factory of concrete sleepers. Elastic pads must have a transition zone deflection calculation to match the characteristics of the elastomer pads and the mat provided by the construction Design.

Due to the different heights of the track sleepers and the concrete sleepers on the bridge, transitional concrete sleepers are installed over a length of 15 m, thus making a gradual change in height, which is in accordance with German regulations.

Technical parameters of the superstructure on bridge structures over 40 m long:

- The width of the track in the straight line and curves 1435 mm,
- Inclination of the axis of symmetry of the built-in rails 40:1,
- Rail fastening system in accordance with SRPS EN 13481:2013,
- Ballast bed made of category I ballast in accordance with SRPS EN 13450,
- The thickness of the ballast under the sleepers in front and behind the bridge min 30 cm,
- The thickness of the ballast below the sleeper, at the place where the rail rests, on bridge structures, min 35 cm,
- Anticipated length of protective rails 25 m, maximum length 30 m.

On this section of the bridge structure over 40 m are the following:

- Bridge at km 76+615.57 DK, L=40.6 m,
- Bridge at km 77+814.32 DK, L=42.05 m,
- Bridge at km 81+650.20 DK, L=154 m,

- Bridge at km 0+751.01 DK, L=138 m,

- Gallery at km 78+401.27 DK, L=110 m,

- Gallery at km 81+283.13 DK, L=38 m,

- Gallery at km 82+159.69 DK, L=57 m.

The graphic documentation shows longitudinal and cross-sections of galleries and bridges, as well as the disposition of tracks on bridges with a safety rail, the position of elastomeric pads for the bridge at km 76+615.57 DK and the disposition of sleepers and safety rails in front of the turnout on the left track of the bridge at km 76 +615.57 DK.

1. Superstructure Design on bridge construction in km 76+615,57 DK, L=40,6 m

The bridge is a static continuous girder system with a span of 11.6 m + 17.4 m + 11.6 m in ballast bed. The bridge is designed in straight line, without a slope.

The left and right tracks of the main line and the freight track cross the bridge. The track axis distance of the left and right tracks of the main line is 4.75 m, and the track axis of the right track of the main line and the freight track is 4.88 m. The speed on the bridge is 100 km/h.

All three tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, in a category I ballast bed.

Type 60E1 safety rails with an elastic rail fastening system are envisaged, which are installed at 10.4 m in front and behind the bridge. Details of the installation of safety rails and sleepers due to the complex track situation in the vicinity of the bridge are given.

In order to increase the elasticity of the base and to gradually change the deflection of the rail during the transition of the prescribed vehicle from the track to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, before and after the bridge for all three tracks.

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was proven that the track is stable in the horizontal plane and that the compressive and tensile stresses, the maximum relative and absolute displacements as well as the horizontal displacements due to the rotation of the ends of the superstructure construction under the vertical load of train within the permitted limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The calculation of the amount of works is given in detail in the Project and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2. Superstructure Design on bridge construction in km 77+814,32 DK, L=42,05 m

The bridge is a static continuous girder system with a span of 11.6 m + 18.85 m + 11.6 m in ballast bed. The bridge was designed partly in a circular curve with a radius of 390 m, and mostly in a transitional curve, with a slope of 4.0 ‰.

The left and right tracks of the main line and the left and right connecting tracks cross the bridge. The speed on the bridge is 80 km/h.

All four tracks on the bridge are made of type 60E1 rails, as well as in the zone in front of and behind the bridge on a length of 50 m, on concrete sleepers 2.6 m long, in ballast bed made of category I ballast, because the calculation showed that the value of additional stresses in the 49E1 rails would be exceeded if they were to be used on the connecting tracks on the bridge, which are in front and behind the bridge of type 49E1 rails.

Type 60E1 safety rails with an elastic rail fastening system are envisaged, which are installed at 10.4 m in front and behind the bridge.

In order to increase the elasticity of the base and to gradually change the deflection of the rail during the transition of the prescribed vehicle from the track to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, in front and behind the bridge on a length of 10.4 m .

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was proven that the track is stable in the horizontal plane and that the compressive and tensile stresses, the maximum relative and absolute displacements as well as the horizontal displacements due to the rotation of the ends of the superstructure construction under the vertical load of train within the permitted limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The calculation of the amount of works is given in detail in the Project and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

3. Superstructure Design on bridge structure in km 81+650,20 DK, L=154 m

The bridge is located on the newly designed section of the Novi Sad - Rumenka main railway line, over the Novi Sad - Savino Selo canal. The bridge is a three-span steel structure with a lattice girder in the middle span. 3 mobile and one fixed bearing are envisaged. The total length of the bridge structure is 56 m + 56 m + 42 m. The right track is in a horizontal curve with a radius of 2000 m, and the left track with a radius of 2004, 75 m, the track is on an ascent of 4.5 ‰.

The left and right tracks of the main line cross the bridge. The track axis distance of the left and right tracks of the main line is 4.75 m. The speed on the bridge is 180 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 60E1 safety rails with an elastic rail fastening system are envisaged, which are installed at 10.4 m in front and behind the bridge. Transitional concrete sleepers on both tracks 15 m in front of and behind the safety rails are planned, and concrete sleepers with a flat upper surface on which the train and safety rail are mounted via double steel support plates.

In order to increase the elasticity of the base and gradually change the deflection of the rail during the transition of the prescribed vehicle from the tracks to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, in front of and behind the bridge.

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was shown that it is necessary to install a rail expansion device of minimum capacity a= ±200 mm above the end mobile support on both tracks at the station km 81+727.2 DK. When

applying this type of expansion device, the calculation proved that the track is stable in the horizontal plane, that the pressure and tension stresses, the maximum relative and absolute displacements as well as the horizontal displacements due to the turning of the ends of the superstructure construction of the bridge under the vertical load from the train are within the permissible limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The calculation of the amount of works is given in detail in the Project and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

4. Superstructure Design on bridge construction in km 0+751,01 DK, L=138 m

In the place of the existing bridge over the Novi Sad - Savino Selo canal, a new bridge construction is envisaged. The bridge is a three-span steel structure with a lattice girder in the middle span. Three mobile and one fixed bearing are envisaged. The total length of the bridge structure is 27.60+82.80+27.60 = 138 m. The bridge is designed in straight line, for the most part, in an ascent of 4.5‰, and after the third pillar it is in a fall of 10‰.

The left and right freight tracks cross the bridge. The track axle distance is 4.75 m. The speed on the bridge is 100 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 60E1 safety rails with an elastic rail fastening system are envisaged, which are installed at 10.4 m in front and behind the bridge. Transitional concrete sleepers on both tracks are foreseen, with a detailed description of the installation due to the complex track situation.

In order to increase the elasticity of the base and gradually change the deflection of the rail during the transition of the prescribed vehicle from the tracks to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, in front of and behind the bridge.

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was shown that it is necessary to install a rail expansion device of minimum capacity a= ±150 mm above the end mobile support on both tracks at the station km 0+820.01 DK. When applying this type of expansion device, the calculation proved that the track is stable in the horizontal plane, that the pressure and tension stresses, the maximum relative and absolute displacements as well as the horizontal displacements due to the turning of the ends of the superstructure construction under the vertical load from the train are within the permissible limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The calculation of the amount of works is given in detail in the Design and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

5. Superstructure Design on gallery in km 78+401,27 DK, L=110 m

A gallery was designed at km 78+401 DK at the point of denivelation of crossing of connecting track number 1 above the main line and connecting track number 2.

The gallery is a static two-span frame system. The supporting structure is made of reinforced concrete slabs and walls.

The connecting track is on the rise of 16.50‰, and from the half of the gallery it is on the decline of 17.50‰, the track is in straight line. The speed of connecting track number 1 across the gallery is 65 km/h.

The connecting track is made of type 49E1 rails, on concrete sleepers 2.4 m long, covered with category I ballast.

Type 49E1 safety rails with an elastic rail fastening system are planned, which are installed at 10.4 m in front and behind the bridge.

In order to increase the elasticity of the base and to gradually change the deflection of the rail during the transition of the vehicle from the tracks to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers.

The calculation of the amount of works is given in detail in the Design and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

6. Superstructure Design on bridge construction in km 81+283,13 DK, L=38 m

A gallery was designed at km 81+283 DK at the place of denivelation of the railway to Bogojevo under the tracks of the main railway.

The gallery is of the frame static system. The supporting structure is made of reinforced concrete slabs and walls.

The tracks are at a 4.5‰ ascent, in a circular curve with a radius of 2000 m. The speed on the main tracks through the gallery is 180 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 60E1 safety rails with an elastic rail fastening system are planned, which are placed at 10.4 m in front and behind the bridge. Transitional concrete sleepers are planned on both tracks.

In order to increase the elasticity of the base and to gradually change the deflection of the rail during the transition of the vehicle from the tracks to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers.

The calculation of the amount of works is given in detail in the Project and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

7. Superstructure Design on bridge construction in km 82+159,69 DK, L=57 m

A gallery was designed at km 82+159.69 DK at the place of denivelation of the left freight track under the tracks of the main line.

The gallery is of the frame static system. The supporting structure is made of reinforced concrete slabs and walls.

The tracks have a 10‰ drop, in the straight line. The speed on the main tracks through the gallery is 200 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 60E1 safety rails with an elastic rail fastening system are envisaged, which are placed at 10.4 m in front and behind the bridge. Transitional concrete sleepers are planned on both tracks.

In order to increase the elasticity of the base and to gradually change the deflection of the rail during the transition of the vehicle from the tracks to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers.

The calculation of the amount of works is given in detail in the Design and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.6.2 SUPERSTRUCTURE DESIGN FOR BRIDGE STRUCTURES OF LENGTH OVER 40 m – SECTION RUMENKA (EXIT) – VRBAS NOVA PASSENGER (ENTRY)

Based on the calculation of the vehicle/track/bridge interaction, Designs were made for the execution of the superstructure for bridge structures over 40 m long.

On this section Rumenka (exit) - Vrbas Nova Passenger (entrance), there is a bridge over 40 meters long, at km 110+351.21 DK.

This Design Book deals with the superstructure on the bridge structure and the superstructure at 10.4 m in front and behind the bridge structure, from the beginning to the end of the protective rail.

The new two-track bridge crosses the Bečej-Bogojevo canal, and is part of the newly designed main line on this section.

The bridge is a static simple girder system, span 63 m with a movable support on the S1 pillar and a fixed support on the S2 pillar, in ballast bed. The bridge is designed in straight line, with a slope of 4.0‰.

The left and right tracks of the main line cross the bridge. The axle distance of the left and right tracks of the main line is 4.5 m. The speed on the bridge is 200 km/h.

The superstructure on the bridge structure has the following characteristics: rails type 60E1, on concrete sleepers 2.6 m long with a flat upper surface on the bridge and at 10.4 m in front and behind the bridge. At the transition zones, concrete sleepers with elastic pads are laid, which achieve a linear change in the stiffness of the base. Elastomeric pads are installed in the factory of concrete sleepers, and it is necessary to ensure the connection of the entire surface of the pad with the sleeper. Due to the different height of track and bridge sleepers, transitional concrete sleepers are provided. The ballast bed is made of Category I ballast. The thickness of the ballast below the sleeper in front of and behind the bridge is min. 30 cm, and below the sleeper on the bridge structure min. 35 cm. An elastomeric mat is planned to be placed under the ballast.

Type 60E1 safety rails with an elastic rail fastening system are planned to be installed at 10.4 m in front and behind the bridge, with installation details.

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was shown that it is necessary to install a rail expansion device with a minimum capacity of a= ±100 mm above the movable support on the pillar S2 on both tracks at the station km 110+351.26 DK. When applying this type of dilation device, the calculation proved that the track is stable in the horizontal plane, that the pressure and tension stresses, the maximum relative and absolute displacements as well as the horizontal displacements due to the turning of the ends of the structure of the superstructure of the bridge under the vertical load from the train are within the permissible limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The graphic documentation shows the longitudinal and transverse sections of the bridge, as well as the layout of the tracks on bridges with safety rails.

The calculation of the amount of work is given in detail in the Project and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that

are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2/2.6.3 SUPERSTRUCTURE DESIGN FOR BRIDGE CONSTRUCTIONS OF LENGTH OVER 40 m – SECTION VRBAS NOVA (ENTRY) – NAUMOVIĆEVO (EXIT)

Based on the calculation of the vehicle/track/bridge interaction, Designs were made for the execution of the superstructure for bridge structures over 40 m long.

Bridge constructions over 40 m long on the Vrbas Nova (entrance) - Naumovićevo (entrance) section are covered in this Design Book.

This Design book includes the superstructure on the bridge structures and the superstructure at 10.4 m in front and behind the bridge structures (from the beginning to the end of the protective rail).

An elastomeric mat is envisaged, which is placed under the ballast bed, and concrete sleepers with elastomeric pads are laid in front of and behind the bridge in transition zones, on the basis of which a linear change in the stiffness of the base is achieved. It is necessary to ensure the connection of the entire surface of the pad with the sleeper, and the pads are installed in the factory of concrete sleepers. Elastic pads must have a transition zone deflection calculation to match the characteristics of the elastomer pads and the mat provided by the construction Design.

Due to the different heights of the track sleepers and the concrete sleepers on the bridge, transitional concrete sleepers are installed over a length of 15 m, thus gradually changing the height.

Technical parameters of the superstructure on bridge structures over 40 m long:

- The width of the track in the straight line and curves 1435 mm,
- Inclination of the axis of symmetry of the built-in rails 40:1,
- Rail fastening system in accordance with SRPS EN 13481:2013,
- Ballast bed made of ballast of Category I in accordance with SRPS EN 13450,
- The thickness of the ballast under the sleepers in front and behind the bridge min 30 cm,

- The thickness of the ballast below the sleeper, at the place where the rail rests, on bridge structures, min 35 cm,

- Anticipated length of protective rails 25 m, maximum length 30 m.

On this section of the bridge structure over 40 m are the following:

- Gallery at km 114+716.45 DK, , L=49.62 m

- Viaduct at km 117+155.43 DK, L=1462.95 m,

- Viaduct at km 131+830.64 DK, L=489.30 m,

The graphic documentation shows the longitudinal and transverse sections of the gallery and two viaducts, as well as the layout of the tracks on bridges with safety rails.

1. Superstructure Design on bridge construction in km 114+716,45 DK, L=49,62 m

The reinforced concrete gallery is formed as a two-story spatial frame construction perpendicular to the main tracks and open from the bottom. The upper bearing plate with vertical walls and columns are fixedly connected into one unit. The construction of the support has two equal spans, the left one for the crossing road, the right one for the secondary line. The tracks on the gallery are in the same direction.

The left and right tracks of the main line cross the gallery, and the freight line passes under the gallery, leaving space for the future road. The track axis distance of the left and right tracks of the main line is 4.75 m. The speed on the bridge is 200 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 49E1 safety rails with an elastic rail fastening system are envisaged, which are installed at 10.4 m in front and behind the bridge. Transitional concrete sleepers are provided on both tracks 15 m in front and behind the safety rails, and concrete sleepers with a flat upper surface are also provided on the bridge.

In order to increase the elasticity of the base and to gradually change the deflection of the rail during the transition of the prescribed vehicle from the track to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, in front of and behind the bridge for both tracks. Installation of the pads should be done in the concrete sleeper factory, and ensure complete adhesion of the pad to the surface of the sleeper. Elastomeric pads must have transition zone deflection calculations.

The calculation of the amount of work is given in detail in the Design and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction

material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

2. Superstructure Design on bridge construction in km 117+155,43 DK, L=1462,95 m

The viaduct is a static system of continuous span support, which consists of a series of simple beams with a span of 32.70 m + 24.70 m + 8x32.70 m + 4x50 m + 3x32.70 m + 50 m + 10x32.70 m + 24.70 m. + 32.70 m + 2x24.70 m + 3x50 m + 2x24.70 m + 5x32.70 m in ballast bed. The construction of the bridge's upper structure consists of prestressed simple beams with a span of 24.7 m and 32.7 m, as well as steel lattice simple beams with a span of 50 m. The bridge is designed in a curve with a radius of 5000 m, at a slope of 5.0‰, half of the structure is rising, and the other half is falling at a slope of 4.0‰.

The left and right tracks of the main line cross the bridge. The track axis distance of the left and right tracks of the main line is 4.75 m. The speed on the bridge is 200 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 60E1 safety rails with an elastic rail fastening system are planned, which are installed at 10.4 m in front and behind the bridge. Details of the installation of safety rails and sleepers due to the complex track situation in the vicinity of the bridge are given.

In order to increase the elasticity of the base and gradually change the deflection of the rail during the transition of the prescribed vehicle from the track to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, in front of and behind the bridge for both tracks. Installation of pads should be done in the factory of concrete sleepers, and ensure complete adherence of the pad to the surface of the sleeper. Elastomeric pads must have transition zone deflection calculations.

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was proven that the track is stable in the horizontal plane and that the compressive and tensile stresses, the maximum relative and absolute displacements as well as the horizontal

displacements due to the rotation of the ends of the superstructure construction under the vertical load of train within the permitted limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The calculation of the amount of works is given in detail in the Design and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.

3. Superstructure Design on bridge construction in km 131+830,64 DK, L=489,3 m

The viaduct is a static system of a series of simple beams with an alternating orientation of the bearing, fixed - mobile. Simple beams were adopted as concrete box supports. The route of the railway in the viaduct zone is in straight line, with a downward slope of 5.0‰.

The left and right tracks of the main line cross the bridge. The track axis distance of the left and right tracks of the main line is 4.50 m. The speed on the bridge is 200 km/h.

Both tracks are made of type 60E1 rails, on concrete sleepers 2.6 m long, covered with category I ballast.

Type 60E1 safety rails with an elastic rail fastening system are planned, which are installed at 10.4 m in front and behind the bridge.

In order to increase the elasticity of the base and gradually change the deflection of the rail during the transition of the prescribed vehicle from the track to the embankment to the transition structure, as well as from the transition structure to the bridge structure, elastomeric pads are provided under the sleepers, in front of and behind the bridge for both tracks. Installation of pads should be done in the factory of concrete sleepers, and ensure complete adherence of the pad to the surface of the sleeper. Elastomeric pads must have transition zone deflection calculations.

By calculating the track-bridge interaction, due to the expansion length of more than 40 m, it was proven that the track is stable in the horizontal plane and that the compressive and tensile stresses, the maximum relative and absolute displacements as well as the horizontal displacements due to the rotation of the ends of the superstructure construction under the vertical load of train within the permitted limits. Calculation of vehicle/track/bridge interaction is an integral part of the Design book.

The calculation of the amount of works is given in detail in the Project and there should not be any major deviations.

The estimated investment value of the works on this section is given according to the estimate from the beginning of 2022, which due to the consequences of the war in Ukraine and the global pandemic with the Corona virus, which led to a price disturbance in the construction material market, is not realistic, and it is possible to expect an increase in the price of the works on the Project .

The Design book was made in detail, including accompanying graphic documentation, in everything according to the valid Laws and Regulations, referring to the valid Standards that are applied on the railway. A detailed description of the materials and works is given in volume 2.2.0 Project of the railway route and stations – substructure and superstructure - Technical conditions, and they form an inseparable whole. Great emphasis in the Design was placed on traffic safety and environmental protection, both during construction and in future exploitation.

All possible changes during the execution of the works must be presented clearly in the As-Built Design, and for changes it would be necessary to obtain the consent of the Designer and the Supervisory Authority. Changes during the execution of works that would significantly deviate from the obtained Building Permit according to which the works are being carried out, are subject to the procedure for amending the Building Permit.